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<p>(54) Title: SYSTEM AND METHOD FOR ENABLING AN IMAGE INPUT DEVICE AND A PRINTER TO OPERATE AS A DIGITAL COPIER</p> <p>(57) Abstract</p> <p>An adapter device is provided for connection to a printer and an image input device, such as a document scanner or digital camera, that enables the printer to operate as a digital copier for image data received from the image input device. The adapter device comprises an input/output controller, memory and a processor. The input/output controller controls the exchange of information with the printer and with the image input device. The memory buffers input device driver software for the image input device and printer driver software for the printer, and also stores image data output by the image input device. The processor is responsive to commands made from a control panel to initiate operation of the image input device under control of the input device driver software. The processor also processes image data from the image input device under control of the printer driver software and generates printer data to be printed by the printer.</p>			
<pre> graph TD Network[Network 400] -- "IMAGE INPUT DEVICE DRIVER SOFTWARE" --> ImageInput[IMAGE INPUT DEVICE 300] ImageInput -- "DATA" --> Adapter[ADAPTER DEVICE 100] Adapter -- "PRINTER DATA" --> Printer[PRINTER 200] Adapter -- "PRINTER DRIVER SOFTWARE" --> Network Printer -- "PC 410" --- Printer </pre>			

SYSTEM AND METHOD FOR ENABLING AN IMAGE INPUT DEVICE AND A PRINTER TO OPERATE AS A DIGITAL COPIER

BACKGROUND OF THE INVENTION

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1. Field of the Invention

This invention relates generally to digital copying, and generally to the field of devices called multifunction peripherals (MFPs). More specifically, the present invention relates to an adapter device suitable for enabling an electronic printer to 10 operate as a digital copier for image data provided by an image input device, such as a scanner or digital camera.

2. Related Art

15 Traditional photocopy machines are analog devices. An original document is scanned and analog signals representative of that document are generated to create a duplicate of it using photostatic principles. In traditional photocopiers, the analog signal information cannot be conveniently stored, given the analog nature of these signals. By contrast, a digital copier is essentially a photocopier machine that converts 20 the scanned image of the document into a digital data format suitable for storage. One significant advantage of a digital copier is that it can produce an unlimited number of copies from one scan of the original.

Multifunction peripherals (MFPs) are peripheral devices that are capable of 25 performing several related tasks, such as document scanning, printing, duplicating, and facsimile transmission and reception. For example, a digital scanner and printer are commonly integrated into a single device. Printing and scanning can each be carried out by utilizing just one component of the integrated device, while both components are used for copying. An example of an integrated printer-scanner is the Medley™ printer/copier manufactured and marketed by Lexmark International Inc.

A disadvantage of an MFP is its lack of flexibility. Consumers that already 30 own a printer or scanner cannot upgrade it to an MFP. Conversely, in some cases, the quality of one or more components of an MFP may match a consumer's need in the

In operation, the processor is responsive to external commands or stimuli from the control panel to initiate operation of the image input device under control of the input device driver software. The processor processes image data from the image input device under control of the printer driver software for generating printer data to be printed by the printer.

The driver software for the printer and the image input device is stored in the adapter device, rather than on a host computer or network. Accordingly, the printer and image input device can be upgraded independently, and the new driver software is installed into the adapter device when an upgrade is made. Moreover, the adapter device includes all of the control hardware and software necessary to operate the printer as a digital copier, thereby eliminating the need for a host computer or network to achieve the digital copier operation.

The above and other objects and advantages of the present invention will become more readily apparent when reference is made to the following description, taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram generally showing the use of an adapter device according to the present invention to enable a printer to operate as a digital copier for image data supplied by an image input device.

FIG. 2 is a detailed block diagram of the adapter device according to the present invention.

FIG. 3 is a flow chart illustrating the overall operation of the adapter device according to the present invention.

FIG. 4 is a chart depicting steps of a method of interfacing an image input device and a printer, according to the present invention.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring first to FIG. 1, the adapter device, shown at reference numeral 100, is designed for use in an environment or system including a printer 200 and an image input device 300. The image input device 300 is, for example, a document scanner

The control panel 110 includes buttons 112 that function as user interface controls to generate commands (stimuli) for operating the image input device 300 and the printer 200. In addition, the status of the copying process and other related information is displayed on a display 114 of the control panel 110.

5 The I/O controller 120 is the connection point to the control panel 110, the printer 200, the image input device 300 and the network 400, and controls the exchange of information to and from the adapter device 100. More specifically, the I/O controller 120 comprises several controllers, including an Ethernet controller 122, a small computer system interface controller (SCSI) 124, and a peripheral connection interface (PCI) controller 128. The Ethernet controller 122 controls the exchange of information with the network 400, such as for receiving the driver software for the printer 200 and for the image input device 300. The SCSI controller 124 controls the exchange of information with the image input device 200, and with the control panel 110. The image input device 300 and the control panel 110 are connected in a "daisy chain" configuration to the SCSI controller 124, as is standard with SCSI devices. 10 The PCI controller 128 controls the exchange of information with the printer 200. These I/O controllers are examples only, and other architecture bus standards may be incorporated into the design and operation of the input/output controller 120. 15

20 The functions of two or more of the I/O controllers may be combined into a single application specified integrated circuit. For example, the function of one or more of the Ethernet controller 122, SCSI controller 124 or PCI controller 128 may be combined into a single circuit together with the function of the memory allocation ASIC 150.

25 Furthermore, the control panel 110 may be connected to a serial port of the printer 200, or integrated into the control panel of the printer. In this case, commands from the control panel are coupled to the processor 140 via the connection between the printer 200 and the adapter device 100.

30 The memory 130 is coupled to the I/O controller 120 and to the processor 140, and serves two primary functions. First, the memory 130 stores the input device driver software for the image input device 300 and the printer driver software for the printer 200. The input device driver software includes the various instructions

processor 140, memory 130 and I/O controller 120. The processor 140 is responsive to commands from the control panel 110 to initiate operation of the image input device 300 under control of the input device driver software. In addition, the processor 140 processes image data received from the image input device 300 under control of the printer driver software to generate printer data appropriate for the image, to be printed by the printer 200.

The adapter device 100 is preferably packaged such that all of the components, with the exception of the control panel 110, are contained within a housing or on a relatively compact peripheral card device. The adapter device includes several connection ports (connectors), a connection port 180 for the SCSI connection to the control panel 110 and the image input device 300 "daisy chain" connected thereto, a connection port 182 for connection to the network 400, and a connection port 184 for connection to the printer 200. The connections are made by standard connectors, which may vary depending on the bus architecture employed. For example, the adapter device 100 may be configured as a peripheral card device that fits into a suitable bus slot, such as a PCI bus slot, of the printer 200. Accordingly, connection port 184 associated with the PCI controller 128 may be a PCI bus connector shown in FIG. 2 that fits into such a bus slot to connect the adapter device 100 to the bus of the printer. Alternatively, the adapter device 100 may be coupled by a parallel or serial cable interface to the printer 200. Still further, the adapter device 100 can be integrated within a printer 200 or within an image input device 300 to enable direct connection between the peripheral devices (without the need for a host computer) thereby imparting the capability of the digital copier operation described herein.

The control panel 110 is preferably kept separate from the housing or card package of the other components of the adapter device 100 so that it can be located in a convenient location, near the image input device 300 or printer 200, for ease of use. Alternatively, the control panel can be packaged together with the other components, in a more fixed configuration.

With reference to FIG. 1, set-up of the adapter device 100 will now be described. During set-up, the adapter device 100 is connected to the image input device 300 and printer 200 as explained above. Power supply for the adapter may be

drive a graphical control panel simulation for display on a portable laptop computer, from which the copying process is controlled. The user driver 510 includes the intelligence that interprets and responds to button events from the control panel 110. The responses that may be generated include updating the user state data structure 560, changing the state of lights and content of the display 114 on the control panel 110, etc. The responses that are generated by the user driver 510 depend on the capabilities of the printer and of the image input device defined by the data structures 550 and 570. For example, the image to be printed can be enlarged or reduced.

The copy driver 520 is responsible for invoking the image input device driver 530 and printer driver 540 in order to operate the image input device and printer to make photocopies of an image generated and supplied as output by the image input device. The copy driver 520 is responsive to the user driver 510 only insofar as a copy function is initiated. All other control between the user driver 510 and the copy driver 520 is through the user state data structure 560.

When a copy is initiated on the control panel 110, the user driver 510 detects the button event and in response triggers the copy driver 520 to invoke the image input device driver 530 to initiate operation of the image input device 300. For example, if the image input device 300 is a document scanner, the scanning process will begin. When the image data from the image input device 300 is received by the adapter device 100, the copy driver 520 invokes the printer driver 540 to generate printer data appropriate for the image data, in order to cause the printer 200 to print that image. The printer can print multiple copies of the image, if desired, based on the print data maintained in the memory 130 (particularly the RAM 132) for that copying event. The number of copies printed, size of the copy printed, scale, etc., are all controlled via the user state data structure 560, within the confines of the features and capabilities of the image input device and printer, defined by the image input device capabilities data structure 550 and printer capabilities data structure 570.

With reference to FIG. 4 in conjunction with FIG. 3, the steps of a method of interfacing an image input device and a printer according to the present invention will be described. Step 610 depicts storing input device driver software 530 for the image input device 300 and printer driver software 540 for the printer 200 in a memory 134

What is claimed is:

1. A device for enabling a printer to operate as a copier for image data received from an image input device, the device comprising:
 - 5 an input/output controller for controlling the exchange of information with the image input device and with the printer;
 - memory for storing input device driver software for the image input device and printer driver software for the printer, and for buffering image data output by the image input device; and
 - 10 a processor coupled to the memory and to the input/output controller, the processor being responsive to commands to initiate operation of the image input device under control of the input device driver software, and to process image data from the image input device under control of the printer driver software to generate printer data suitable for printing by the printer without using processing resources of a host computer.
2. The device of claim 1, further comprising a control panel coupled to the processor via the input/output controller, the control panel comprising user interface controls for issuing said commands to operate the image input device and the printer.
3. The device of claim 2, wherein the user interface controls of the control panel comprise a plurality of buttons and a display, wherein the processor is responsive to said commands that are generated in response to actuation of one of the plurality of buttons, and the processor generates status information for display on the display of 5 the control panel.
4. The device of claim 1, wherein the memory comprises an erasable and programmable memory module that is capable of being rewritten with input device driver software for a particular image input device.

13. The device of claim 1, and further comprising a bus connector for connecting to a bus of the printer for exchanging information therewith.

14. In combination, the device of claim 1 and a printer, wherein the input/output controller is coupled to a bus of the printer for exchanging information therewith.

15. A system for interconnecting a printer and an image input device, comprising:

- (a) an image input device capable of supplying as output image data to be copied;
- (b) a printer capable of printing print data supplied as input thereto;
- (c) an adapter device for connection between the image input device and the printer, the adapter device comprising:
 - an input/output controller for controlling the exchange of information with the image input device and with the printer;
 - memory for storing input device driver software for the image input device and printer driver software for the printer, and for buffering image data output by the image input device; and
 - a processor coupled to the memory, the processor being responsive to external commands to initiate operation of the image input device under control of the input device driver software, and to process image data from the image input device under control of the printer driver software for generating printer data to be printed by the printer.

16. The system of claim 15, wherein the image input device is a scanner.

17. The system of claim 15, wherein the image input device is a digital camera.

18. The system of claim 15, wherein the adapter device further comprises a control panel connected to the input/output controller and comprising user interface controls for issuing commands to operate the image input device and the printer.

wherein the processor is responsive to commands generated by actuation of the buttons in order to initiate operation of the image input device and the printer.

24. A device for enabling a printer to operate as a copier for image data received from an image input device, the device comprising:

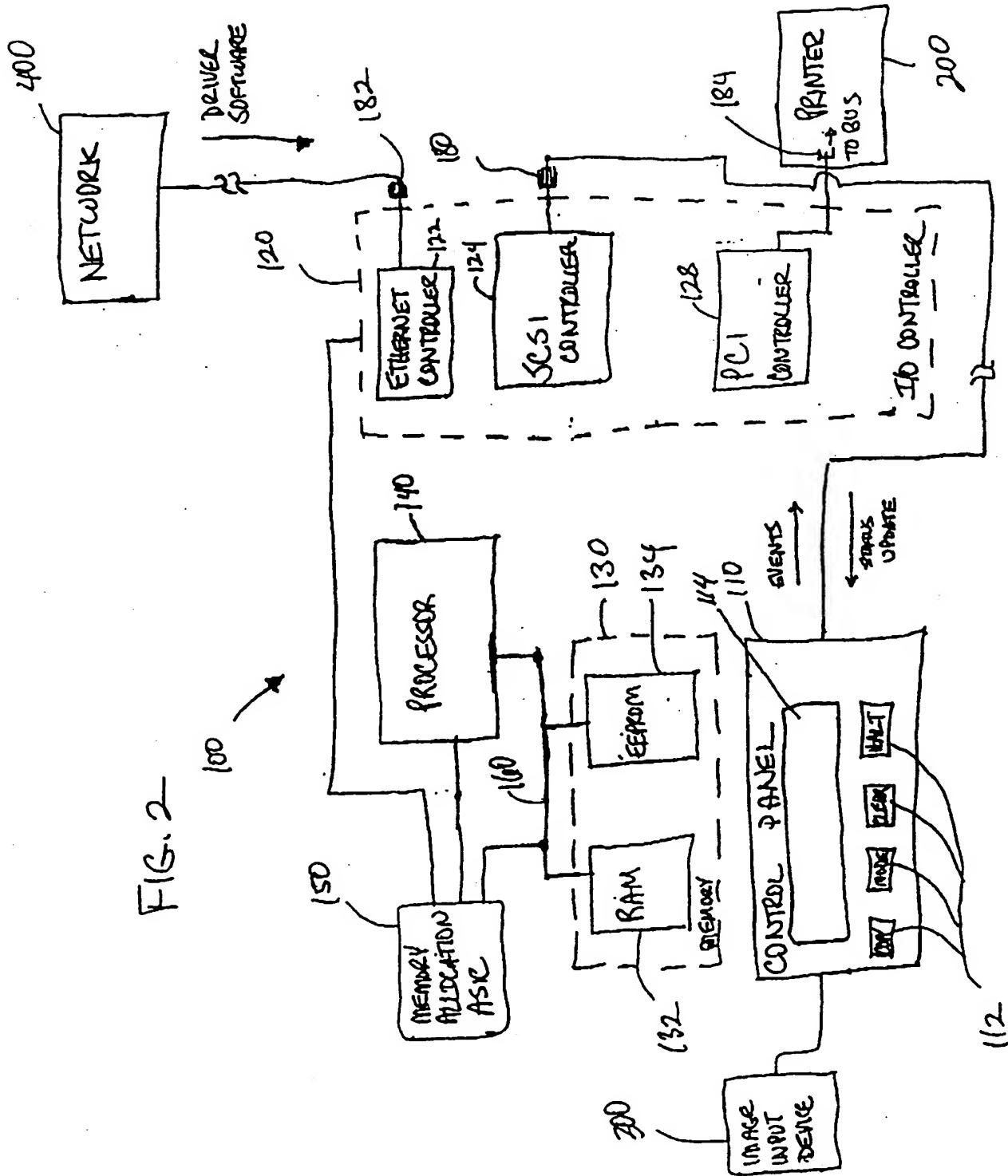
control panel means comprising user interface controls for issuing commands to operate the image input device and the printer; and

5 processor means coupled to the control panel means and responsive to commands to initiate operation of the image input device, and to process image data from the image input device to generate printer data suitable for printing by the printer without using processing resources of a host computer.

25. The device of claim 24, wherein the user interface controls of the control panel means comprise a plurality of buttons and a display, wherein the processor means is responsive to said commands that are generated in response to actuation of one of the 5 plurality of buttons, and the processor means generates status information for display on the display of the control panel means.

26. The device of claim 24, and further comprising memory means coupled to said processor means, the memory means comprising an erasable and programmable memory module that is capable of being rewritten with input device driver software 5 for a particular image input device and with printer driver software for a particular printer.

27. The device of claim 26, wherein the memory means comprises a random access memory module for buffering image data output by the image input device.



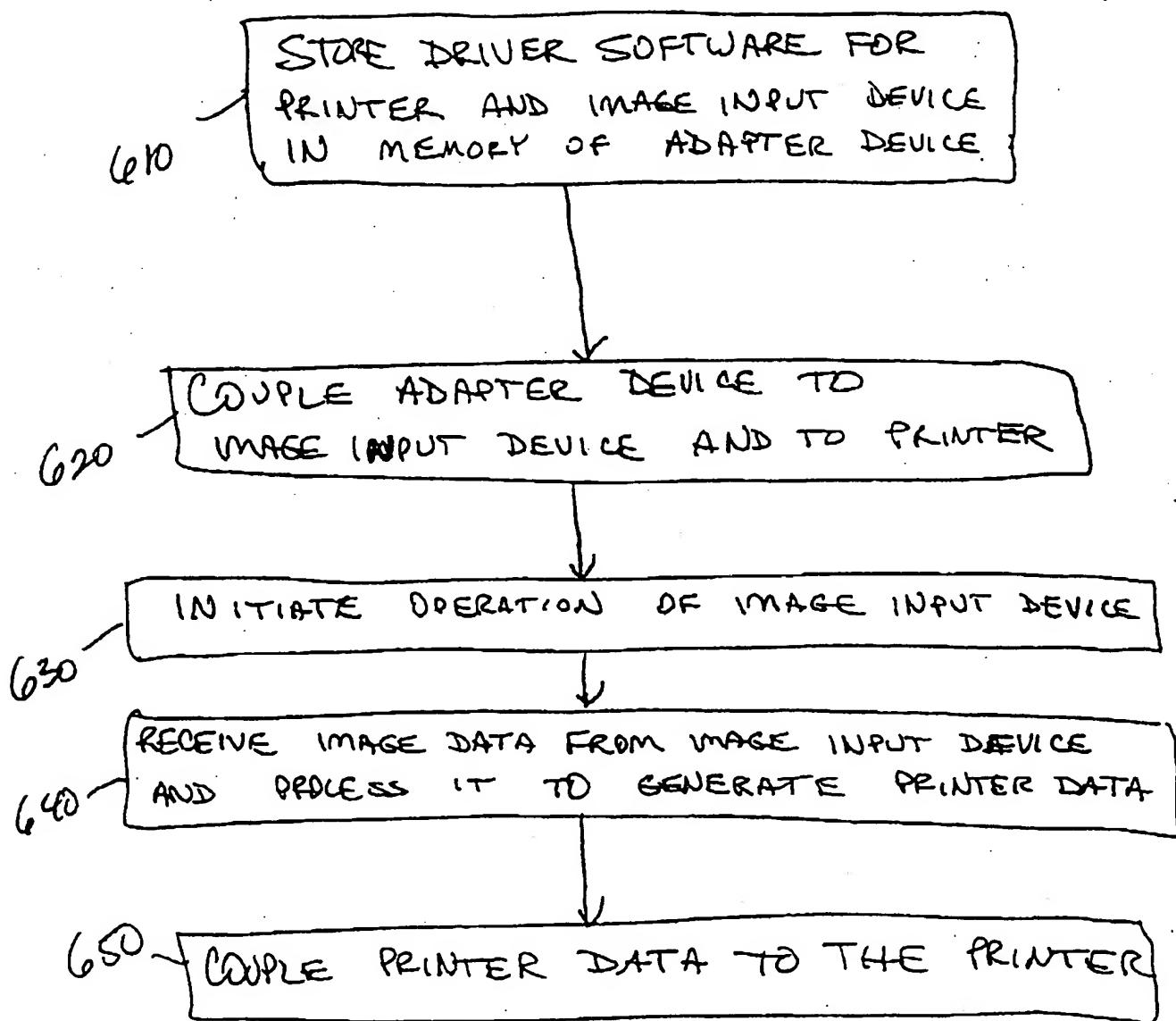


FIG. 4